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ABSTRACT

This pamphlet is the fifth in a series of ten stemming from the view that language is central to learning, that teachers can gain insights into their work and into learning by examining the language of the classroom, and that current language theory can be the means to such insights. The pamphlet reports on a case study involving a twelfth grade student, undertaken to discover the language experiences of the secondary school student and the role that differing language forms play in the educational success and satisfaction of students at this level. It contains the following: brief statements of theory and opinion relating to language teaching and usage, excerpts from the subject's class notes, excerpts from two lessons, and excerpts from transcripts made of the subject's comments about a paper she had written and about the special languages used in different courses. (FL)

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Language in the Classroom: A Series. 5

STUDENTS SPEAK OUT

A Not So Comprehensive Look At What's Really Going On

Patricia Harvey

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TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

With special thanks to:

Elizabeth, Carolyn, Lisa and Gordon

the students who made this study

both possible and enjoyable.

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4. Talking, Writing and Learning
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FOREWORD

This pamphlet is one of a series, produced as discussion papers by a group of teachers who participated in a graduate course in the Department of Curriculum and Instruction at the University of Calgary. In development, the papers reflect the method of the boys of Barbiana: each paper has been shaped and tempered, through several stages by the input of the group. In intent, the series reflects the aims of the pamphlets originated by the Writing Across the Curriculum Project Team of the Institute of Education at the University of London, to whom we are indebted for pointing the way.

The series stems from a view that language is central to learning, that teachers can gain insights into their work and into learning by examining the language of the classroom, and that current language theory can be the means to such insights. Further, the series represents a conviction that teachers are in the best position to understand the heuristic role of language in the classroom as well as to assess the needs of children in the schools and that they are the most likely to find solutions for problems in classroom practice. To realize this potential and to extend their influence, teachers need to offer their ideas and experiences freely and be willing to consider the ideas of their colleagues openly. It is in this spirit of sharing that these pamphlets are published.

We are grateful to Al Kahanoff, Principal of Bruton Junior High School in Calgary for his generous editorial assistance and for his help in seeing the pamphlets through publication.

We also wish to thank Miss Lorraine Cockle for the cover design.

James Britton
Merron Chorny

Education is the process of acquiring and using new information. The standard medium of transmission of new information is language. Secondary schools, particularly high schools, introduce their students to a variety of special language codes; students change classes and language codes at a rate which caused one high school student to term the experience "a kind of language shock." Expectations and requirements in terms of the specialized needs of each course cause students to alter their formal language communication many times each day. Still teachers tend to place emphasis, often far out of proportion to the students' needs, on the language of the subject, and students speak of needing ten minutes to adapt their thinking and speaking patterns from one class to another.

Concern for these problems lead me to look into the special situation of the language expectations of the secondary school student, and the role that differing language forms play in the educational success and satisfaction of students at the high school level. My 'look' became a case study - one day's lessons in a typical high school for a Grade 12 student.[1]

The format of the study was simple - tape recordings were made of both lessons, notes were collected, textbooks in both subjects were examined and other lesson-related materials were made available for study. From these materials, items were selected for transcription, two sets of

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1. I felt that looking at the varying language activities which formed a portion of a regular day for one student would enable teachers to appreciate the changes which can occur for a student at a Grade 12 level moving from, in this case, Social Studies to Mathematics as a portion of her regular time-table.

additional tape recordings were made and one piece of writing was done especially for the study. I felt that these materials would make it possible to examine two areas of concern:

1) the varieties of language experiences which the student met in a day, and
2) the nature of subject language as it is used in the high school situation.

Growing from these basic concerns was a further consideration. If high school subjects place heavy emphasis on the specialized language of the field (especially in areas such as Mathematics and Social Studies), are students hampered in their learning because they are unable to come to terms with the language code which is being used? If that is the case, what role should specialist language take in the learning experience of the student who is new to a subject which relies heavily on a special vocabulary? Does the language of the subject precede working with the ideas and concepts of the subject, or should terms grow from the work which is being done? Which way is it actually happening in school? It must be noted here that this study cannot pretend to speak for all secondary school language situations, but it is felt that it can at least be termed 'typical' of the high school situation.

This study begins with and operates throughout on certain assumptions concerning the role of language in the classroom, and is particularly concerned with previous research which has been done in the field of secondary school language forms and registers by Barnes (1969),[1] Britton (1970)[2] and Rosen (1972),[3] and the University of London Writing Research Team (1974).[4]

The investigations which were done relied heavily on the method used by Barnes in his study of secondary school language, but it has been altered to place its central emphasis on the student and her reaction to the educational situation, rather than on the teacher as Barnes did in his work. The crucial addition to the collection of materials in lesson situations are the tape recordings of the discussions which were used to examine the role that subject language played in the discussion of subject material outside the classroom, as well as in conversations with people who were not familiar with specific topics which were discussed during evaluation of lesson materials.

VIEWPOINTS

Specialist language in the scondary school - just what is its role? Who uses it and why? Where does the student-novice fit in? Is the school even aware that highly specialized linguistic forms might create difficulties for the student which could cause him to turn off in a subject before he has even begun? What are the theories? The opinions?

> "Teach the student to speak and understand the language before they can learn the subject. It may be dull for them, but they can't be expected to go on until they have it."
>
> (high school teacher)

> "The notion of 'providing vocabulary' is a limited and misleading one, suggesting an all too static conception of language. Language in use is a flow, a current of activity and not any sort of reservoir. The words a child can come by in this deliberate fashion at the teacher's providing - in the course of a vocabulary lesson - will tend to be of limited use, necessary at times but with little power to vitalize the current of speech. Teachers need to care about the flow - about 'reading as though it made sense' and writing and talking - and when they

do, the reservoir will look after itself. To put it another way, it is from successive experiences of words in use - words used for some actual profit or pleasure - that a child builds up his resources and there is little point therefore in our dragging things in by their 'names'"

(Britton)

"I find that I have to keep simplifying my questions until I get them down to their level. They know the answers, have the information, but they can't understand my questions. I find it frustrating that I have to keep simplifying and simplifying. It certainly slows things down."

(high school teacher)

"Most subject learning comes to be expressed almost entirely in impersonal language; this becomes more and more true as our pupils progress through secondary school".

"When used effectively this language is weighty, detached, highly respected and fulfils the special needs that it has been evolved to meet. But it is also the product of man's mature experience through the centuries. It is the language of educated adults; for pupils, it is hard and remote."

(Rosen)

The opposing viewpoints expressed here seem to set the problem clearly. Many teachers at the secondary school level look upon their task as one of operating with the language known to them as specialists in a given field, an academic specialty. They need to establish a context with their pupils in which subject knowledge can be transmitted; they see themselves as having a limited time in which to accomplish the task. All too often the common ground is established and maintained by means of terminology, oriented to the subject, but often far removed from the language background of the student. As a result of this approach, students often find themselves unable to make any kind of meaningful transfer of knowledge gained primarily through use of terms which bear little relationship to other

learning experiences or to everyday situations. They seem hemmed in by the terms, and rather than acquiring new information which is useful to them, they become concerned over the right words, the names of things.

Work done by the Writing Research Unit at the University of London and reported in their pamphlet, From Information to Understanding,[5] shows clearly how this process works. Students learn the terms and use them in apparently correct ways, but deeper investigation often reveals a genuine lack of understanding. Students think in the words but they lack the accompanying concepts.

This situation was especially evident in the tapes which were used to examine student knowledge of a subject area. There was a strong feeling that if one could name it, one knew it. It did not seem to matter that students had no idea what the term was used for, or had no idea of any practical use to which the knowledge could be put. They believed they knew it, even when they were unable to define or use the term in any way other than to give the very specific definition which they had memorized. Where such approaches exist, students do not develop a real understanding of the material and are often left far behind, while still paying lip service to a new understanding by displaying an ability to meet the formal linguistic requirements of the course.

This situation brings up the dichotomy. Teachers may begin by teaching the language and then the content, or they may choose to use the language which the student brings to the course and gradually introduce the specialized language when the students understand the role specialist language will play in aiding their understanding. Experts in language acquistion

tend to feel that specialist language imposed from above will be less successful in fostering deep understanding of a subject, and the materials collected in this study seem to bear this out, even though we worked in a limited situation within a limited time period.

It is unfortunate that a study of this sort cannot, in fact, attempt to examine student language growth throughout a long period of time, such as over a total semester in an effort to trace language growth, but this study does seem to suggest that much of the language learned by students during a semester may be forgotten very rapidly once the semester is over. In all cases, our discussion tapes were made after the semester had ended, and all tapes have comments to the effect that the material is hard to recall because there is no need for it any longer.

Our tapes and notes also seem to reveal another fact about specialist vocabularies. There seems to be no effort made to introduce the terms and to investigate student's understanding of the terms which are to be used at the beginning of courses. Following is the outline from the first page of Liz's Social Studies notes:

Values

Instensic value, basic value — happiness
Life, good health, success? — can neither be proven right or wrong.

Instrumental value — leads to instresic value
good health leads to happiness

Only search is for happiness. Edeness (kindness)
pleasure is the only intrensic value
— anything a person does is done for his own selfish gain.

estitic values — beauty and goodness.

Life, good health, success?, can neither be proven right or wrong.

Instrumental value — leads to Intresnsic value
good health leads to happiness

Only search is for happiness, Edeness (kindness)
pleasure only Intrensic value
— anything a person does is done for his own selfish gain.

Estitic values — beauty and goodness

1. What is the problem posed with Introduction to this book?
2. Define positive knowledge and normative knowledge.
3. What is the difficulty...when disagreement is based on different value judgements?
4. How does a student guard against indoctrination by course or teacher?
5. Define demorcracy, dictatorship public enterprise, private enterprise, traditional society, value judgement, factual judgement, fact.
6. List and explain the three resources of an economy.
7. Describe 3 economic problems, must be solved in all economies.
8. Where does the poer rest in a tradition society, democracy, and dictatorship?
9. What does the author say is the objective of the text?
10. What are the 3 functions of Government?

2. Positive Knowledge; is facts, describing the world past and present using scientific method of observation and research, these facts are discovered. (WHAT IS)
Normative Knowledge; derived from moral teachings, teachings of right and wrong, which build up our set of value judgements. Desirable and undesirable. (WHAT OUGHT TO BE)

The passage contains two words which are obviously unfamiliar to Liz, because, as she later says, misspelling is often her cue that a word is not known to her, and yet there is no evident effort to define the terms either on her part or, if the notes can be used as a valid indicator, on the teacher's. Why? Is there an assumption of shared context on both sides?

From Liz's mathematics notes, again the first page:

Sequences and Series

Arrangement of numbers = 3,5,7...
Sum of a sequence = series 3+5+7=
Infinite and finite
3,4,5... 3,4,5.

Arithmetic Progressions
e.g. 3,5,7,9,11 = Finite Arithmetic Sequence
= common difference (5-3)=2
(7-5)=2 etc.

General Arithmetic Sequence
e.g. $a_1, a_2, a_3, \ldots a_n \ldots$

$a_1, a_1+d, a_1+2d \ldots a_1+(n-1)d$

$a_n = a_1+(n-1)d$ n^{th} term of an arithmetic sequence or general term

e.g. 15^{th} term — First term = 3
arithmetic diff = -1
3,2,1...or n = 15
(3_-1), (2+-1)

$a_{15} = a_1 + (n-1)d$

$= 3 + (15-1)(-1)$

$= 3 + -14$

$a_{15} = -11$

e.g. Find common difference
= an - a (n-1)d

Arithmetic Progressions

e.g. 3,5,7,9,11, = finite arithmetic series

= common difference (5 - 3) = 2
(7 - 5) = 2 etc.

General Arithmetic Sequence

e.g. $a_1, a_2, a_3, \ldots\ldots a_n$

$a_n, a_{n+1}, a_{n+2}, \ldots\ldots a_{n+n}$

a = -n term of an arithmetic sequence or generalization.

It would appear that in these two areas at least, teachers seem to assume a great deal of prior knowledge on the part of their pupils, and if student notes are to be taken as a indicator, language which is heavily oriented to the subject is used early in the term with very little discussion of its meaning to the student. These samples seem also to suggest that subject language as perceived (and copied) by the student, and as used by the teacher, often relies heavily on standardized definition format — easy to memorize and easy to test. Where language seems to be touching on more generalized concepts or attitudes, as in the Social Studies transcript, definitions do not appear even though they would likely be most valuable to later review.

The notes which have been referred to above continue for a whole semester. Their nature does not vary particularly, and the adult Mathematics or Social Studies specialist who looked at them would likely find them 'adequate'. To such a person the language used would appear to be clear, but a bit brief. The real question is what does it mean to the student? When Liz attempted to use her notes as a 'review' before we made our discussion tapes, she expressed some degree of dissatisfaction at what she had thought to be adequate information at the time they were made.

But, the subject specialist would argue the classroom situation is the one in which students really learn to deal with the language of the subject. The lecture-discussion-work situation is the one in which they begin to incorporate their new learning with the old knowledge. As has been said earlier, we taped one full day of lessons in Liz's first

semester of Grade 12, and we examined the lessons to see first of all what was happening in the lesson itself, and secondly, to see how much of what was happening in the lesson could be recalled and used by Liz at a later session.

THE STUDENT

Elizabeth (often referred to in transcripts as Liz) showed great interest in the study from the beginning, and made a number of observations on educational theory and practice which were very valuable in formulating some aspects of the study. She believes in educational challenge, in sharing knowledge as a means to better understanding, and in a degree of educational freedom. All of these concerns show on the discussion tapes which were made as a follow-up of the lesson tapes, and made her a excellant partner for the study.

Writing about herself after all of the taping had been completed, Elizabeth said:

> As a student, I'm not top-notch stuff, yet through repetition, I am able to understand slightly the words used. In math, knowing is absolutely essential; it's right or wrong. If you don't know what a quadratic function is, there's no hope of knowing what to do with it. This is where my problem comes; my mind doesn't retain names. When I hear something I've heard before, then my mind clicks in and starts to comprehend.
>
> In English, well, it's essentially the same. I don't understand all the terms used during the course, but in English it's possible to get the gist of the lesson. It is a hindrance in writing. I just don't know my basics.
>
> It is hard to determine Social terms, there aren't a great number. Social is strictly a memory subject, memorizing names, dates, places, that's it. Most terms found in social classes are not applicable to your everyday life. But then I guess you don't use Math a great deal either.

> I can't say that I'm always comfortable using the same language as the subject requires, but usually it is necessary to use the jargon because there's nothing else that explains as well.
>
> My first reaction to subject language is "ugh", then after thinking about the matter, I realize how important it really is. It's rewarding when you find you actually can apply the knowledge you've gained.

Her concerns for education, language and what school is doing for her quickly became a central concern of the research which we undertook.

THE FORMAT

What follow are short segments of two lessons which we taped. The segments are portions of class periods which ran for sixty-six minutes each, and were selected because they were typical of the activities that took place during each class period. Often on the discussion tape, reference is made to topics not appearing in the segments of the class tape which were transcribed. We felt that a longer unified segment of the discussion would be superior to a shorter chopped-up selection, and on that basis we made our choice.

Reading through these transcripts, one should note the linguistic emphasis which has already been pointed out. Teachers in secondary schools regard themselves as subject specialists - they have a considerable background in their field, one beyond the level of knowledge of their students, and they have done what they want to encourage their students to do - they have mastered the subject language. They know the language of the subject and their use of terms and phrases from the field is evident. Through the tapes one also perceives the focus of the students. They reveal a concern for detail, a confusion over forms

and a focus on that which is familiar. It is interesting to note that the two concerns are not always the same.

THE STUDENT

The Lessons: I

The Social Studies lesson which was taped was a review lesson in preparation for an examination the following day. The format appears to be basically one of lecture and questions. The portion transcribed here is typical of the total lesson.

Teacher: ...The first thing we want to talk about today is the United Nations...You'll find that this organization was set up in a way very similar to the League of Nations...and...uh...the League's worth was seen long before the end of the war...As you know, they had already started calling the allies pet names long before the end of the war...The actual formation was done...through a number of meetings. First one at Moscow, 1943...and there the foreign ministers of...uh...the core countries that were independent at the time, not taken over by some Axis power...the United States, USSR, Britain...China, decided they were going to have to set up some kind of united nations organization...Brenda?

Student A: I thought that they didn't have um...Russia in the United Nations right at first, did they?

Teacher: Umm...

Student A: Did they?

Teacher: Yes...yes...it was always there. It was one of the ...it was one of the nations that agreed that they were going to require something and this was the sort of thing. Secondly, there was a meeting at Dumbarton Oaks...Dumbarton Oaks...

Student B: Dunbarton?

Teacher: Yes...spelled just like it sounds...D-U-M-B-A-R-T-O-N ...Dumbarton Oaks...1944, and there they drew up the draft of the United Nations...

Student B: Where was that in?

Teacher: Dumbarton Oaks is...um...just outside of Washington, D.C. And by the...the charter was drawn up and... copies were sent to different countries and they finally met in San Francisco in 1945...April of 1945. This was signed initially by about 50 countries. Today, there's...um...something on the order of 130 to 135 countries in the United Nations, because ever since the Second World War we have been giving independence to countries in Asia and...um...Africa and so forth. And as they do...become independent, they ...um...they gain membership into the United Nations.

Student B: How...how many countries would there have been first signed in San Francisco?

Teacher: Around 50...50...yes. Where the structure of this organization was almost the same as the League of Nations...the...um...different parts of the United Nations would be as follows: First of all the Security Council...Security Council. This was as the name would imply...set up to insure security for the member countries and on this council...there were five permanent seats...and these would go to the major countries...United States...USSR...Britain... France...and China. Now at this time of course, it was Nationalist China with Chiang Kai Chek...the communists hadn't taken over yet. There would be ten more permanent seats connected by...by the General Assembly for 2 year terms...ten non-permanent seats selected by the General Assembly for 2 year terms... and there was more or less a gentlemen's agreement that the same ones would be on it all the time. It would be a kind of rotation sort of thing...so that Canada would be on it and on it again and so...in essence it would be a permanent nation. Also the five powers...permanent powers...in the Security Council would have the power to veto so that if any one of them disagreed with the decision, there negative vote would...um...stop any decision of the Security Council.

> Now what has actually happened since the Security Council was formed is that...um...the Soviet Union and...um...later Communist China...um...much later Communist China, have used the veto so often that it's pretty well made the Security Council an impotent...it has very little power and is not able to do its job because of this veto power. The Soviet Union has used it hundreds of times...

In this portion of the lesson it is easy to see that the teacher is relying heavily on the terminology connected with the subject (in this case the special names connected with the United Nations) and appears to be drawing on presumed prior knowledge that students possess concerning the League of Nations. What is of particular interest to this study is that Liz did the first transcripts of this material, and although not generally a bad speller, she misspelled three words which were used in the lecture to convey rather important connotations: veto (vito), impotent (imputant), and allies (alias). In the light of her later comments concerning proper spelling as an indicator of real knowledge, these errors seem noteworthy.

Later discussion of this tape revealed that much of the knowledge which is presumed in the course of this lecture was not available to Liz. She does not doubt that she has heard these things before (her notes show clearly that she has), but she simply does not remember them, and cannot recall the information needed to help her make sense of the details which are being reviewed.

After the lesson and the work on the transcription of the tape, Elizabeth was asked to review, for our study, some of the terms which

had been mentioned on the tape. This sentence introduces the lesson:

> "The first thing we want to talk about today is the United Nations...you'll find that this organization was set up in a way very similar to the League of Nations...

of the underlined terms Elizabeth writes:

> United Nations: Peace makers formed to settle disagreements without battles. There are representatives of all major powers. Wasn't formed until WW II when it was absolutely necessary.
>
> League of Nations: Built upon 10 points created by Truman, and when was finally materialized, U.S. was uninvolved because of political problems. L. of N. was an actual farce because of lack of cooperation and percentage of great powers.

She was also asked to put the first sentence into her own words as a partial measure of what her expectations for the lesson might be and to partially evaluate her retained knowledge:

> "After the League of Nations failed, it was still necessary for the powers of the world to come together and attempt agreement. This is the beginning of the United Nations. This organization contains councils and running laws similar to the League. It's better because of the addition of Russia, U.S., etc., making it a complete U.N."

Elizabeth has a picture of the peace-keeping function of the United Nations and undoubtedly she has brought into her definitions knowledge beyond the classroom. She has also incorporated into her definition language which for her draws a memorable picture, especially her

description of the League. But, she has made some errors in the recalling of facts. Her notes on the topic indicate that Wilson developed the 10 points, although her notes only show 9 (and they don't seem to be fully understood).

> Form League of Nations
> based on Wilson's 10 points (principles)
>
> - had no revengeful anger
> - abolition of all secret diplomacies
> - no private seas
> - removal of economic barriers
> - reduction of armourment
> - evacuation of Russia
> - reparton of Belgium
> - acceptance of self determination
> - evacuton of vulcans

Also of note is the fact that later in her notes she has carefully underlined the Truman Doctrine. No notes on the United Nations which outlined the definition which was produced could be found, although reference is made in passing to some of the United Nations agencies:

> General Assembly was not to have much power. Council was strong arm (collective security) — never did have all the major powers.

This particular entry becomes very interesting as it progresses because all further reference appears to be to the League of Nations; in fact, this confusion of the two bodies seems very common throughout Liz's notes, suggesting a number of cross-references which may have been very difficult for some students to keep apart. The notes viewed in total seem to be a long list of seldom defined terms, place names, document

names and dates. One cannot help but wonder as to the value of this collection when one refers to Elizabeth's comment on her notes. (In the following, I use the term "researcher" rather reluctantly, but I felt it advantageous to distinguish between the subject teachers and the writer.)

Researcher: What about terms in Social?

Liz: Like what?

Researcher: I don't know. I suppose any kind of governmental term.

Liz: I don't know any of them.

Researcher: But they were certainly there...I've been looking through your notes. I saw them.

Liz: Check the spelling...that helps. You don't ...you usually don't know a word if you can't spell it...

Researcher: That's an interesting observation...

Liz: ...unless you're just used to talking it and you don't know.

Researcher: Well, you did take notes. Were you given notes? I mean were you given notes on the board? Did you just take them down...as he talked...?

Liz: You take them down...

Researcher: OK, what do you write down?

Liz: (laughing) The things he repeats...I usually just write running notes...people hate my notes...usually can't understand them. I take running notes, just keep writing and writing and if there's something that goes up there, I just go whoosh!

Researcher: Do you write down things you understand or things you don't understand?

Liz: If you write down...well...if you write down the things you don't understand, they don't appear as much. Like I was thinking of some of the things in Social...because he's sitting there talking and I couldn't pick out a single note to write down...because I couldn't understand what he was saying. You can't... you can't write down something that you don't know what they're saying unless you write a sentence and you can't...you never write as fast as someone talks...

Researcher: So you end up writing down things that are more familiar to you?

Liz: Well...words...yeah...or things that are repeated...
He has a habit of saying, "Now make sure you have this down"...and usually what he said... you were supposed to write down...he didn't give you filler-ins. He gave you sentence, pause, sentence, pause, ...sentence pause... so everything he said was meant to be taken down.

An example of this emphasis can be seen in a portion of the transcript of the original lesson, when Student B shows a great deal of concern over the correct spelling and the exact location of Dumbarton Oaks.

Reviewing these materials, however, leads one to wonder whether this emphasis on such things as places and correct spellings may be an attempt on the part of the students to locate some common ground from which to begin coping with the much more complex materials which compose the major portion of the course.

When Liz in discussion says that she writes down what she is already familiar with rather than material which is new to her, secondary school teachers would do well to question the value of note-taking, and it might be suggested that note-making from other sources would suffer the same fate.

This is one of the dilemmas of the teacher's task. How do students use notes? What purpose do they serve? It would appear that notes serve some purpose. They do enable students to review material at a later date. They do tie ideas or concepts together and throughout Liz's notes the mixing of the familiar and the unfamiliar seems to help her place new ideas into patterns already understood, but notes should be a useful tool for the student. It would seem wasteful if notes could not form the basis for meaningful learning and review. Teachers must consider the role which notes are to play and begin using these materials as the basis for later work. One cannot help but wonder what difference would occur if Liz's notes had been used as a starting point, possibly for small group talk, rather than an end — what you do in class even though as she says, you don't really know why.

Research has shown that students can learn from their talk, learning which according to Searle[6] and the University of London Writing Research Unit[7] is often more meaningful to the student than lectures and other materials presented by the teacher.

The process of working through problems with the 'aid' of subject language and of the subject teacher can be essential, however, as is shown in the second lesson transcript.

The Lessons: II

In the Mathematics lesson which was taped it was again easy to observe the role which specialist language played in the on-going process of the lesson. The lesson itself was somewhat different in nature, in

that it was a review lesson immediately before the final comprehensive examination. In this situation, students were questioning the teacher on specific problems, and topics under discussion were quite varied. For purposes of transcription, we chose one segment of the lesson which seemed to exemplify both the nature of mathematical language and the variety of terminology which was encountered by students in the course.

Teacher: You've got the idea...we can say that vector OO...

Student A: ...is 1.35

Teacher: ...that vector OQ = result of vector OP plus PO...okay...OQ is the resultant of those two. Now we can go back and say now the result is equal to the sum of two vectors: Therefore, by the definition of adding vectors, we can say that x is equal to the first coordinate... y is equal to the second...no...(undecipherable) but I think the idea is there...that's all we can do on that...

Student B: Well...c is part of r...

Teacher: Oh...I see what you're trying to get at...a plus x...you're saying x is a plus c and I'm putting down a plus x. How did we get from a plus x to plus c...will x and c be the same point?

Student B: ...yes...

Teacher: Careful...not necessarily. In fact, definitely not...right?...because it's a parallelogram. That side's sloped...it's not very well drawn, I agree...but x and x would not be the same point. How could we get that then? They're equal to a plus c instead of a plus x...Jill?

Student C: Couldn't you take the resultant of a plus b? Would it equal x and y? Then you have x...

Teacher: Hold it a minute there...let's look at that. You said take the resultant between a, b and add...

Student C: ...x,y...

Teacher: x one...that's two points...how do you take the resultant between...

Student C: ...well...

Teacher: You can take the vector between those two and have a point here and a point there...

In this section of transcription, two interesting features seem evident. The language of the subject is virtually the only form of communication which exists between members of the class and the teacher, and the teacher seems to be the only individual who is completely at ease with the terms which seem to be required for the material. It seems obvious that the students have no other way of dealing with these mathematical concepts, and that all of their knowledge is bounded by the terms which they have encountered.* This observation may seem a bit overrated at this point, but is very definitely borne out when the students attempt to discuss their mathematical knowledge with other people, as was shown on later tapes, which discussed the lesson and some of the terms used.

This tape was to me the most fascinating. I am not a mathematician and listening to it was like hearing a foreign language. In it one sees

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* The knowledge of the students centered on two facets of the subject — the terms which were used and the diagrams which were used throughout the taped lesson in order to illustrate all points which were being made. Diagrams helped the students visualize the concepts. The students engaged in much repetition throughout this tape and it is obvious that they are attempting to come to an understanding of a language which bears little relationship to their everyday experiences. Mathematics seems to be subject language at its ultimate.

clear evidence of students actually coming to grips with concepts which have been only vaguely understood and actually solving a problem using the language which the subject has given them. What was somewhat distressing to me was the fact that students were often unable to free themselves of the specialized language in which they had learned the subject in order to make it meaningful to someone who lacked the specialist knowledge.

In a later discussion of Mathematics, Elizabeth joined forces with Carolyn and we looked at certain terms used on the tape. In preparation for the tape in which Liz and Carolyn attempted to teach me some mathematics, both girls looked at the transcript and then attempted to explain some of the terms. We found from the start that our language was highly oriented to the subject and that we were very much bound by mathematical conventions. We soon found, as well, that we had to draw diagrams, use notes and work our way slowly through the terms with something which could often only be called guesswork. A portion of the mathematics discussion tape reveals a particular attitude:

Researcher: If somebody said to you define...explain... talk about a parallelogram, what would you do?

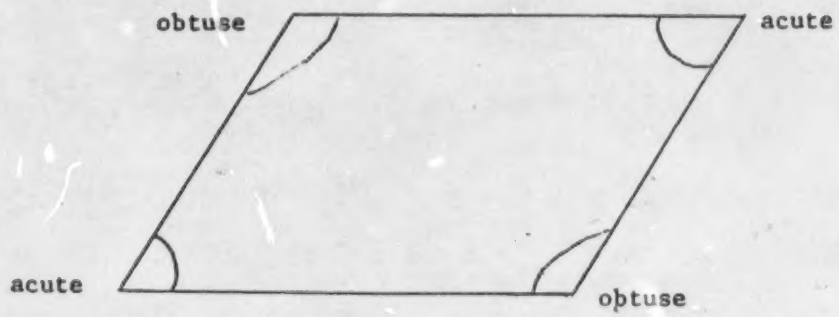
(Laughter)

Carolyn: Okay, it's got four sides, two...um...two sides are...

Liz: Parallel...

Carolyn: Parallel...I mean the two side sides are parallel ...the two bottom sides are parallel (Laughter) ...and it slants...that's right...there's no

right angle...there's one obtuse angle and one...an acute angle...on the same...well, here I'll show you on my little sheet of paper...(Laughter)



At this point, as Carolyn pieced together her definition of a parallelogram, both students began to draw diagrams, because, as Liz explains later on her evaluation tape, mathematics is easier to understand when it is visualized.

Researcher: When you learned it...(a definition)...did you learn by a written definition or did you learn by seeing?

Liz: You learned it like when we were showing you on the paper...one line looks like this and one line looks like that.

Researcher: ...and you learned it by that rather than by...

Liz: ...you couldn't define it really...like when we defined it, you had to have a picture there or it would be a lot of bother and this and that...

It seemed from this comment that mathematics is a subject which relies heavily on visual images, and as our discussion progressed, another fact became clear. Mathematics is a language of examples, used so often by the students that they become very real and all-explaining to the students, but seemed to me to become almost rote repetitions of known facts

done with little or no knowledge of use beyond the situation:

Carolyn: Oh! Oh! I remember, you can divide it into two triangles...

Liz: I knew there was something else you could do with it.

Carolyn: There's some kind of a formula...a formula for it ...what is it...is it a rotunda or something... ...no (great laughter)

One has to assume that Carolyn is aware of further terms, but it is obvious that she has forgotten the name of the 'thing' she seeks. When this happens, the search is abandoned. As the tape progresses, she says, while looking at Liz's notes:

> Can't we just freshen up on this?...Is there anything to freshen up with?

Appraisal of Liz's notes showed that in fact there wasn't anything which would meet Carolyn's needs, but as we later discovered, some things aren't easy to forget:

Researcher: You used the terms acute and obtuse quite comfortabley, so I assume...

Carolyn: Those two things I do know...

Liz: Well, they drill it in to you from grade eight!

Carolyn: Yeah...and we use it quite often. All I know is that...I can't remember...oh...I can remember...there's two acute angles and they're opposite each other and there's two obtuse angles and they're opposite each other and when the triangle...I mean the parallelogram is divided in two...

Liz: Oh! The straight line thing...they have to equal 180...

Carolyn: That's it!...yeah!...those are supplementary ...right?...or something...like that...

Researcher: Now I really don't remember. What does supplementary mean?

Carolyn: Supplementary...now I'm not sure about this... but it's where your ninety...like these two angles will equal one another because...

Liz: No...

Carolyn: Yeah, because if you extended...okay...you will notice that your parallelogram goes like this...this is your obtuse and this is your acute angle...do you understand?...and so that's supplementary!

Carolyn: There is something where you can divide it in four...(deletion - reminiscing about who was in whose class)...well, there's something where it was divided into four and that's all I remember...

Liz: This one is shorter...that one's shorter...that one's longer...that's all he told us.

This section of the tape strongly suggests the immediacy of mathematical knowledge. There are constant references on the tape to the time that has passed since the courses and topics under discussion were learned; both students acknowledge that information is remembered in a serial fashion - one item will cue another bit of information, and knowledge is

built up in this shared fashion. But, as the tapes show, a great deal of the original information is not retained, even though it was considered essential at the time. One wonders whether part of the problem is the complex nature of the language which is used and which appears to rely on total recall of facts before they can be used. On the final tape which we made, Liz comments on the role of 'remembering the term' and how it happens for her:

Researcher: How do you feel about the language of math as it is used on you or for you?

Liz: I haven't got the basics yet!

Researcher: So when a term is mentioned, what happens?

Liz: (Laughing)...I usually...it clicks in kind of... after he is on his next sentence.

Researcher: So you pick it up. Do you automatically think of a definition when somebody says something to you in Math?

Liz: No, you think of an example...

Researcher: You draw a picture in your mind?

Liz: Well in a sense...yeah...like I didn't learn what an obtuse and an acute angle was until this year ...and now this is Math 30...because I didn't need them. Oh, this looks all right, not bad...

Liz is freely acknowledging the role that guesswork can play in learning and using information, but it is interesting to note that now that she is in Math 30, she has learned something that she had been approximating before.

The acquiring of terminology without ability to adapt the learning, and reliance on examples to teach, shows up on a later section of the Math discussion tape, when Liz and Carolyn are attempting to explain vectors to me:

Researcher: I don't know a thing about vectors. Tell me.

Carolyn: I know something about vectors?

Liz: What's a vector?

Carolyn: Yeah, Liz...let it all out...you know...you were in class.

Liz: That doesn't mean anything...a vector...would you get out of here? (Laughter)...a vector shows the magnitude...what is the magnitude, you ask...of course...it is the distance and the speed...so sorry...

Researcher: That doesn't help me!

Carolyn: Or me!

Liz: It doesn't!

Researcher: We're both lost.

Liz: Well, I learned about vectors!

In all fairness, it should be noted that this portion of the tape is filled with laughter, and that Liz is quite aware, as shown by the tone of her voice, that the information which she is giving us means very little to her - she is attempting to use the definition which she has been taught. The tape did carry on, and we got down to business.

Carolyn: Back to what your're going to draw...draw!

Liz: Okay...a line is going in a direction, right?

Researcher: Okay.

Liz: And when we're working with vectors, we're working with two forces...one going up and one going that way...

Carolyn: They can go in any direction. I thought I'd just like to point that out...

Liz: ...and we just worked with two forces...um... where would the object end up was the point... is that right?

Carolyn: Yes...the resultant...

Researcher: So when...what...you use them when you're planning a graph?

Liz: Well...yeah...they end up on graphs...

Carolyn: No!

Liz: Yes they do!

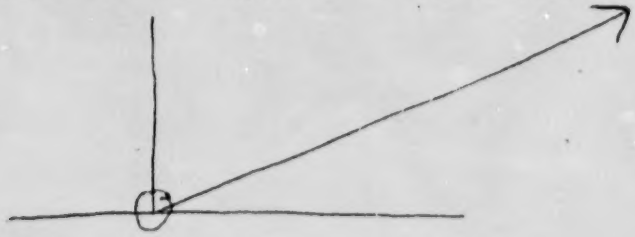
Carolyn: Do you mean is that the x and that the y?

Researcher: Yes.

Carolyn: No! No! No!...it wouldn't even be like that. Look, for example, there's our...

Liz: So she draws a graph...

Carolyn: Okay...no...okay...no, you can...you can use a graph...draw a graph right here. Now there's one force going off this way...say it's about 10 pounds...it's a 10 pound force going that way and there is going to be another force going out this way...we'll say that's a 20 pound force...now our object is to find the resultant-



Liz: This is the parallelogram...

Carolyn: Well...yeah...that's right! This is where the parallelogram comes in...we...you just... okay...

Liz: You always head to tail it...you put the tail of this weight...

Carolyn: Right to here...so that we can find our resultant?...We put it out to like that and see how those two lines are parallel...

Liz: ...and then you have another line across here, going...

Carolyn: ...going this way...and see this is equal to this, so that's 10 pounds and this is equal to this, so that's 20 pounds and the resultant comes right in between the two...because...like for instance ...um...

Liz: ...that's the combined thing and that would be the speed ...that would be the resultant...the magnitude of these two put together...it is the shortest distance between two points...

Carolyn: Do you understand that?

Researcher: Yes, I think I understand...I'm just trying to work it in. What kind of a problem do you get? What's it for?

Liz: What's it for? Don't look at me? Well, like he gave examples of taking a pencil or something... no...pushing on something...like if you take that arm and I took this arm and we pulled...you'd be able to figure out where she'd go...

Carolyn: No...that is not a good example...no. I wouldn't go anywhere...I'd just be pulled apart!

Following this, Liz and Carolyn attempt a second example, using a penny and special forces, and in a delightful exchange, they use exactly the same knowledge and exactly the same terms to get to exactly the same point:

Carolyn: See right here, for example, we'll use...I've got it...I've got the greatest idea...okay...we have a penny right here...

Liz: Good show...

Carolyn: ...now we have this...this gravitational...or what...some funny kind of pull...pulling it this way...okay? (laughter) No, I'm trying to get it so that you can understand...(laughter) Now you've done it...

Liz: Now you've done it...

Researcher: Bringing it down to a simple level...Carry on.

Carolyn: There's this penny...

Liz: Supernatural force...

Carolyn: And there's this pull...this force just pulling it along this way...

Liz: A magnet?

Carolyn: A magnet and a penny doesn't work...

Liz: Get a copper magnet then...

Carolyn: Okay, we'll get a special kind of magnet...and this force is a 20 pound force just pulling it, now it happens that...it happens to be that there is this other force coming along and it decides to pull the penny too...so...

Liz: ...two magnets...

Carolyn: ...and this force here is 40 pounds...okay...

Researcher: Yes.

Carolyn: Now this penny is getting kind of upset...(laughter) ...well, he doesn't know where he is going to go... so we are going to figure out where he goes...okay ...now what we're going to do is find out where this penny will end up because there's these two forces pulling on him...we're going to draw this force over here, just so we can, you know...we're just going to do it...

Liz: ...to make it all one force...

Researcher: Uh...I see...yes...okay...

Carolyn: Okay, we're going to take this force and put it over here and...to see where the penny will end up...and your penny will end up right here.

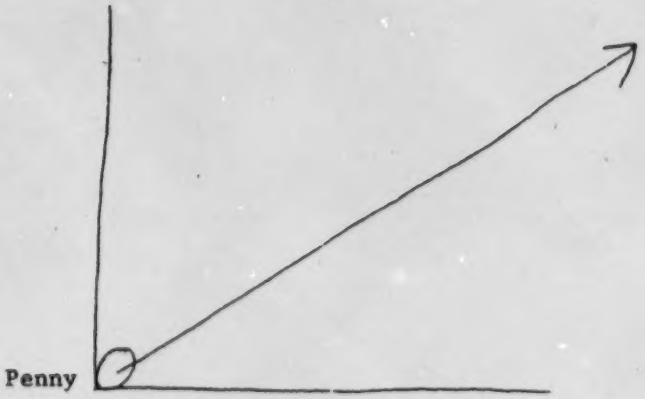
Researcher: At the point where the two lines meet?

Carolyn: Yeah...that's right...do you understand?

Researcher: Um...ah...

Carolyn: That's a good example, if I do say so myself...

Liz: Good show...



They seem unable to grasp the idea of showing how the information could be used, other than to solve hypothetical problems. The question which remained at the end of the whole section was what is it for? The students simply don't know. They seem very happy with the terms and enjoyed using them to try and teach me something, but they were quite unable to grasp my difficulty in comprehending the language which they were using.

It would appear that in this case, at least, the language of the subject has become so essential to using the knowledge that students are unable to discuss the material any other way. (It might further be speculated that the topic is so far removed from their lives, they can see no point in attempting to transfer the information into a more usable form. If the only place you need to know about vectors is in a Math class, maybe it is easier just to learn the Math forms.)* On the final tape, Liz makes a comment about a paper she wrote:

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* The problem seems to be one of traditional format. Classes have taken on the language of the subject and often forget that some of the learning jobs which are to be done could be done as well in other ways. This shows up not only in Mathematics, but in other fields. English teachers isolate Creative Writing and emphasize writing, Social Studies looks for research papers, and the Sciences emphasize precision of description.

> Oh, I was so mad at my teacher...(Name)...like I'm not... I don't usually write in a very formal style. It's rather ...I don't know what it is...I haven't quite decided yet.. but I wrote a term paper, and I was having a riot writing it. Of course, he didn't enjoy it much, because he said it wasn't a very scientific approach (laughs)...it sounded like a novel...

Is there no place for novels as well as term papers? Is there no place for magic pennies in Math? If there is, why don't teachers say so, much more loudly, so that students would be willing to take risks, and make information really their own?

In our final tape which we made for the purpose of evaluating all the material with which we had been working, Liz and I talked of many things which had not come to light on earlier tapes. Some of the items from that tape provide an interesting study in the role language plays in the learning experience of the student.

Liz: Breaking the language code...you want me to write about that? About myself breaking the language code?

Researcher: Yes, did you ever find yourself all of a sudden, BOOM, I've got it! This is all falling into place...

Liz: Have you ever seen a light bulb turn on?

Researcher: Has it happened to you?

Liz: It happened in math...I know that...I don't remember what it was...I remember it happening...I was so excited...

Researcher: Because you finally got through it...

Liz: Yeah...well...yeah...it doesn't dawn on you when it happens. I remember one time I was sitting in math class and I wasn't even really listening...and (name) said some words and I go, hey that makes sense now ...you know...it kind of just kind of comes in...

Researcher: Does it stay with you...once you have it?

Liz: Now that I've forgotten it, I guess it doesn't, does it?

And she goes on from that rather depressing comment on learning to talk about a new language and the frustration she encounters:

Researcher: When you're learning a new subject, does it take priority?

Liz: If you're...well, not if you're frustrated. If you're frustrated...(throws hands in air)... if you're interested, okay...

Researcher: What do you do if you're frustrated?

Liz: If you're frustrated, as in the term <u>frustrated</u>, you quit...usually...but if you're not quite so frustrated, you kind of plug along...now, I'm almost frustrated in Chemistry...

Researcher: And you're hoping for the light?

Liz: Yes! Oh yes!

Researcher: And you wait for it?

Liz: It comes on every now and then.

When asked about the heavy demands of the special language forms of such subjects as Chemistry (her new problem) and Mathematics (her old one), Liz's answer was in keeping with references she had made in earlier discussions concerning the fact that subject language (or jargon, as she often calls it) is simply the most efficient way of communicating within a field.

Researcher: Should subjects emphasize subject language?

Liz: Yes.

Researcher: <u>Yes</u>, you say, automatically...why?

Liz: (laughing) Of course, you're supposed to emphasize subject language. If a...a subject is what the language is...you can't go into a subject with...you can't go into Math with English terms...it doesn't work...so a subject is what the language is...

Researcher: Do we emphasize those too much? Rather than doing math questions, should you learn the language?

Liz: No, applying is learning...

Researcher: Which way? Given the term later?

Liz: Well, you give the term...and for some people that seems it...and then you start applying the term... and then you...the teacher uses the term all the time so the term sort of becomes a part of what you're doing...and then it becomes a part of your thinking ...of course it doesn't all happen lickety-split, but...(laughs)

Researcher: It is quite possible that we could take you through a course and have you obtain for your purposes a perfectly adequate understanding of Math and not know the terms...you could do... but not know the terms...

Liz: I don't think you could do it.

Researcher: For sure?

Liz: Well, you could if someone was sitting over your shoulder and telling you to put that number up on the top there and you put it down there on the bottom...and you divide into the other number there and you sort of point...sort of like...No, you have to use the terms <u>numerator</u> and <u>denominator</u> and <u>divider</u> ...you have to...you have to know what the term <u>dividing</u> is...you have to know what the term <u>multiplying</u> is...or you can't do it...

One cannot help but wonder about this mystical power with which the terms have been endowed, such that the operations for which they stand cannot be discussed without reference to them.

Liz: You can't answer a question if you don't have the terms...you can't answer a question if it has that term in it...

It was at this point that the dilemma of subject language and new knowledge became most crucial. Terms are essential. Learning proceeds as new information becomes confined and fitted in with old. This relationship of new and old knowledge and the importance of helping the student use new knowledge to enhance 'old' and make it even more meaningful has been thoroughly discussed in the work of Vygotsky (1962),[9] especially when studying the development of scientific concepts in children. Liz's point that terms are the handles which allow students to do the task matches closely with Vygotsky's findings that new terms enable students to tie together previously unrelated information into concepts which in turn allow them to categorize later information and make use of all information more quickly. A problem seems to occur when students don't pick up the generalizations, when they retain the terms, but don't create the generalization.

The previous transcript points out most clearly my strongest impression from all lessons, notes and discussions which were used in collecting this information. Learning is seen to be mastering the terminology. Little concern was shown by the students for practical application of what they had learned. They took on the mode of the subject when they were talking about it, and altered their language codes to suit each subject area as it was mentioned. In all cases, specific questions within a subject field brought a memorized response initially, a response which was later developed wherever they found it possible to do so. This discovery made it possible to make some observations on the students' perceived

difficulty in moving from class to class. The language expectation are very different in the classes which were taped; students make such a noble effort to move from one language form into another. However, it is not surprising that they find it difficult to adapt their thinking to suit each new situation. I had not realized just how subject-oriented the language of the secondary school is, and I am inclined to wonder whether educators have allowed the teaching of the terminology to come to stand for knowledge of subject, allowing students to hide behind strings of words which serve to appear as knowledge, while successfully hiding from the student, by the same process, the fact that he really hasn't learned very much.

This material suggests to me that we must clarify our goal in the secondary school, not just in terms of courses and credits, but also in terms of what we hope our students will know and understand when they leave school. I sincerely hope that our measure of knowledge is not lists of definitions, and here I speak as much of students as teachers, because no matter what we, as teachers' may believe we are teaching, students often seem to see learning as the mastery of easily remembered or written items which might be used for examination. It is a cycle which seems to be permanent.

The material included here is obviously limited — it is only two lessons in one day with one student, but it is not atypical and when accompanied by comments from Elizabeth it may fulfil its function — get secondary school teachers thinking about the goals of classroom teaching

at this level. Specialist language has a very definite role to play — students need to be familiar with what real understanding of the language can do for them, but we can't allow such language to swamp our students, terrify them and turn them away from concepts which should be part of their knowledge. It is possible that it is time that subject teachers looked at language in all its forms in their classrooms to see just what is happening and to consider whether what's happening is what they really want.

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